TRI-PARTY AGREEMENT

Change Notice Number TPA-CN- 668	TPA CHANGE NOTICE FORM	Date: 6/17/2015
Document Number, Title, and Revision: DOE/RL-2011-104, REV. 0, Characterization Sampling and Analysis Plan for the 200-DV-1 Operable Unit		Date Document Last Issued: January 2012
Originator: Mark Byrnes		Phone: (509) 373-3996

Description of Change:

Update Table 1-2, "COPC for 200-DV-1 OU Waste Sites," pgs. 1-15 & 1-16, to delete Radium-226, Radium-228, and Thorium-232 from the COPCs and add footnote "i".
Update Table 2-1, "Analytical Performance Requirements for Radionuclides," pg. 2-7, to delete Radium-226, Radium-228, and Thoriuim-232.
Update Table 2-2, "Analytical Performance Requirements for Nonradionuclides," pgs. 2-9 & 2-10, to modify required soil detection limits for Aluminum and inorganic constituents.
Update Table 2-4, "Field and Laboratory Quality Control Requirements", pg. 2-18, to modify field quality controls.
Add section 3.2.1.3, "Sonic Capability and Continuous Coring Approach," pgs. 3-71 & 3-72.
Add text to section 3.2.8, "Corrective Actions and Deviations for Sampling Activities," pg. 3-79.
Add text to section 4, "Health and Safety Plan," pg. 4-1.

Mike Cline (**DOE**) and Dib Goswami (**Lead Regulatory Agency**) agree that the proposed changes modify an approved workplan/document and will be processed in accordance with the Tri-Party Agreement Action Plan, Section 9.0, *Documentation and Records,* and not Chapter 12.0, *Changes to the Agreement.*

All deletions are indicated by ~~strikeout~~ and additional text to clarify the change has been done in double underline.

Copies of the pages affected by the changes are attached.

Justification and Impacts of Change:

This TPA CN is needed to incorporate the Sonic Capability and Continuous Coring method that will impact the 200-DV-1 OU Field Sampling Plan. This method will eliminate the need for a twin borehole approach as well as present the opportunity to reduce risk and exposure to the drilling team and to the samplers. This method will allow the driller to push through intervals of high radiological risk without excavating any of the highly-contaminated radioactive sediments. Once soil samples are collected and the pushes are at depth, the well could then be geophysically logged from the same borehole. An extension of the DPT borehole sampling depths may be needed to assess the full extent of contamination, at the request of lead regulatory agency, with concurrence from DOE. Additionally, this TPA CN is needed to update tables for COPCs, analytical requirements, and quality control, which must be kept current to ensure that data quality objectives are met. Radium-226, Radium-228 and Thorium-232 are now classified as naturally-occurring background radioisotopes and were deleted both from the list of COPCs and from the list of analytical requirements.

Approvals:

[signature] DOE Project Manager	6/18/2015 Date	[X] Approved [ ] Disapproved
N/A EPA Project Manager	Date	[ ] Approved [ ] Disapproved
[signature] Ecology Project Manager	6/22/15 Date	[X] Approved [ ] Disapproved

Table 1-2. COPC for 200-DV-1 OU Waste Sites

Radiological Constituents			
Americium-241	Europium 154	Plutonium-238	Technetium-99
Carbon-14	Europium-155	Plutonium-239/240	~~Thorium-232~~[i]
Cesium-137	Hydrogen-3 (Tritium)	~~Radium-226~~[i]	Uranium-234[h]
Cobalt-60	Neptunium-237	~~Radium-228~~[i]	Uranium-235
Europium-152	Nickel-63	Strontium-90	Uranium-238
Iodine-129[a,e]			Uranium-233[e,h]
Inorganic Constituents			
Cadmium	Lead	Ammonia/Ammonium	Nitrate/Nitrite
Chromium	Mercury	Chloride	Phosphate
Chromium(VI)	Nickel	Cyanide	Sulfate
Copper	Silver	Fluoride	Aluminum[b]
Antimony[b]	Manganese[b]	Selenium[b]	Uranium (total)[b]
Arsenic[d,e]	Barium[e]		
Organic Constituents (BY Cribs, 216-B-42, 216-T-18, 216-T-19, 216-S-9, 216-S-13, 216-S-21 waste sites only)[f]			
Tributyl phosphate[g]	Normal paraffin hydrocarbon (kerosene)[c]		
Organic Constituents (216-T-19 waste site only)[d]			
1,1-Dichloroethane	1,2-Dichloroethane	*cis*-1,2-Dichloroethylene	*trans*-1,2-Dichloroethylene
1,1,1-Trichloroethane	Acetone	Benzene	*n*-Butyl Benzene
Carbon tetrachloride	Chlorobenzene	Trichloromethane (Chloroform)	Dichloromethane (Methylene Chloride)
Ethyl benzene	Methyl Ethyl Ketone	Methyl Isobutyl Ketone (hexone)	Phenol
Polychlorinated biphenyls	Tetrachloroethylene	Toluene	Trichloroethylene
Xylene			
Organic Constituents (216-S-13 waste site only)[e]			
Methyl Isobutyl Ketone (Hexone)	Polychlorinated biphenyls		

a. Not identified for the 200-TW-1 or 200-TW-2 OUs, but included on waste-site specific basis for the 200-DV-1 OU.

b. Identified as a contaminant of concern in Table 2 of DOE/RL-2004-10, *Proposed Plan for the 200-TW-1 Scavenged Waste Group, the 200-TW-2 Tank Waste Group, and the 200-PW-5 Fission-Product Rich Waste Group Operable Units.*

c. Analyzed as total petroleum hydrocarbons (kerosene).

d. Identified as a COPC for 216-T-19 waste site only, in accordance with DOE/RL-2007-02-VOLII-ADD3, *Site-Specific Field-Sampling Plans for the 216-B-42 Trench, 216-S-13 Crib, 216-S-21 Crib, 216-T-18 Crib and 216-T-19 Crib and Tile Field in the 200-TW-1/200-PW-5 Operable Units*, AD3-6.0.

e. Included for previous 200-PW-3 OU waste sites only (216-S-13), in accordance with DOE/RL-2007-02-VOLII-ADD3, AD3-3.0.

f. Included for previous 200-TW-1/200-PW-5 OU and 200-PW-1 OU waste sites only (216-B-42, BY Cribs, 216-T-18, 216-T-19, 216-S-9, 216-S-13, 216-S-21), in accordance with DOE/RL-2007-02, *Supplemental Remedial Investigation/Feasibility Study Work Plan for the 200 Areas Central Plateau Operable Units: Volume I: Work Plan and Appendices.*

g. Analyzed as tributyl phosphate only.

h. Analyzed as U-233/234 by uranium isotopic alpha energy analysis.

Table 1-2. COPC for 200-DV-1 OU Waste Sites

i. Background radionuclides (potassium-40, radium-226, radium-228, thorium-228, thorium-230, and thorium-232). These naturally-occurring background radionuclides were identified by consensus of Tri-Party managers as not directly related to Hanford operations or processes in the Central Plateau.

COPC = contaminant of potential concern
OU = operable unit

1.4 Data Quality Objectives

In early 2011, DOE and Ecology met with site technical experts for a series of facilitated DQO sessions. These sessions reviewed the current state of knowledge for the 200-DV-1 OU sites and developed principal study questions, decision statements, alternative actions, and other data objectives and requirements. The data needs were then determined on a waste site-by-waste site basis to address the principal study questions. Then, the sampling and analysis recommendations in the existing Central Plateau Supplemental Work Plan (DOE/RL-2007-02) were modified as needed to address the 200-DV-1 OU data needs. Through this process, a final set of data requirements was derived. The 200-DV-1 OU data needs and the results of the DQO process for the 200-DV-1 OU waste sites will be documented in the work plan for the 200-DV-1 OU. This SAP describes how those characterization data will be collected.

Table 1-3 lists the DQO principal study questions and decision statements.

Table 1-3. Summary of DQO Principal Study Questions and Decision Statements

<table>
<tr><th>Principal Study Question #1</th><th>Alternative Actions</th></tr>
<tr><td rowspan="2">Do chemical and/or radiological contaminants in the shallow (0-4.6 m [15 ft] bgs) vadose zone at 200-DV-1 OU waste sites pose an unacceptable risk to human health and the environment under current and/or potential future land use?</td><td>No Action.</td></tr>
<tr><td>Remediate waste site to reduce risk to acceptable levels.</td></tr>
<tr><th colspan="2">Decision Statements</th></tr>
<tr><td colspan="2">#1-1 Determine whether the chemical and/or radiological contaminants within the upper 4.6 m (15 ft) at the 200-DV-1 OU waste sites exceed acceptable risk levels for human health and the environment.</td></tr>
<tr><td colspan="2">#1-2 For the 200-DV-1 OU waste sites requiring remediation, determine the extent of chemical and/or radiological contamination within the upper 4.6 m (15 ft) sufficiently for remedy selection.</td></tr>
<tr><th>Principal Study Question #2</th><th>Alternative Actions</th></tr>
<tr><td rowspan="2">Do chemical and/or radiological contaminants in the vadose zone from 200-DV-1 OU waste sites pose an unacceptable groundwater risk to human health and the environment under current and/or potential future land use?</td><td>No Action.</td></tr>
<tr><td>Remediate contamination to reduce risk to acceptable levels.</td></tr>
<tr><th colspan="2">Decision Statements</th></tr>
<tr><td colspan="2">#2-1 Determine whether the chemical and/or radiological contaminants in the vadose zone exceed acceptable risk levels for groundwater.</td></tr>
</table>

Table 2-1. Analytical Performance Requirements for Radionuclides

COPC	Chemical Abstracts Service No.	Preliminary Action Level[a] (pCi/g)				Hanford Site Background[d] (pCi/g)	Name/ Analytical Technology	Required Detection Limits		Soil[e] (%)		Water[e] (%)	
		Human Health (15 mrem/yr[b])		Groundwater Protection[c]	Ecological Protection			Water (pCi/L)	Soil (pCi/g)	Precision	Accuracy	Precision	Accuracy
		Industrial	Unrestricted										
Americium-241	14596-10-2	335	--	--	3,890	--	Americium isotopic – AEA	1	1	≤30	70-130	≤20	70-130
Carbon-14	14762-75-5	97,300	--	--	--	--	Liquid scintillation	200	50	≤30	70-130	≤20	70-130
Cesium-137	10045-97-3	23.4	6.2	--	115	1.05	GEA	15	0.1[f]	≤30	70-130	≤20	70-130
Cobalt-60	10198-40-0	4.9	--	--	692	0.00842	GEA	25	0.05[f]	≤30	70-130	≤20	70-130
Europium-152	14683-23-9	11.4	--	--	1,520	--	GEA	50	0.1[f]	≤30	70-130	≤20	70-130
Europium-154	15585-10-1	10.3	3	--	1,290	0.0334	GEA	50	0.1[f]	≤30	70-130	≤20	70-130
Europium-155	14391-16-3	426	--	--	15,800	0.0539	GEA	50	0.1[f]	≤30	70-130	≤20	70-130
Iodine-129	15046-84-1	3,080	--	--	5,670	--	Chemical separation low-energy photon spectroscopy	20	2	≤30	70-130	≤20	70-130
Neptunium-237	13994-20-2	59.2	2.44	--	1,900	--	Np-237 – AEA	1	1	≤30	70-130	≤20	70-130
Nickel-63	13981-37-8	3,070,000	--	--	--	--	Ni-63 – liquid scintillation	15	30	≤30	70-130	≤20	70-130
Plutonium-238	13981-16-3	470	--	--	6,230	0.00378	Pu isotopic – AEA	1	1	≤30	70-130	≤20	70-130
Plutonium-239/240	Pu-239/240	425	33.9	--	6,110	0.0248	Pu isotopic – AEA	1	1	≤30	70-130	≤20	70-130
~~Radium-226~~	~~13982-63-3~~	~~7.03~~	—	—	~~50.6~~	~~0.815~~	~~AEA~~	~~1~~	~~0.1~~	~~≤30~~	~~70-130~~	~~≤20~~	~~70-130~~
~~Radium-228~~	~~15262-20-1~~	~~8.15~~	—	—	~~43.9~~	—	~~AEA~~	~~3~~	~~0.2~~	~~≤30~~	~~70-130~~	~~≤20~~	~~70-130~~
Strontium-90	10098-97-2	2,410	3.8	--	22.5	0.178	Total radioactive strontium – GPC	2	1	≤30	70-130	≤20	70-130
Technetium-99	14133-76-7	412,000	8.5	--	4,490	--	Tc-99 – liquid scintillation or GPC	15	15	≤30	70-130	≤20	70-130
~~Thorium-232~~	~~7440-29-1~~	~~4.8~~	—	—	~~174,000~~	~~1.32~~	~~Th isotopic – AEA~~	~~1~~	~~1~~	~~≤30~~	~~70-130~~	~~≤20~~	~~70-130~~
Hydrogen-3 (tritium)	10028-17-8	139,500	--	--	174,000	--	Tritium – liquid scintillation	400	400	≤30	70-130	≤20	70-130
Uranium-233/234[g]	U-233/234	2,440	--	--	4,830	1.1[h]	U isotopic – AEA or ICP/MS	1	1	≤30	70-130	≤20	70-130
Uranium-235	15117-96-1	101	--	TBD	2,770	0.109[i]	U isotopic – AEA or ICP/MS	1	1	≤30	70-130	≤20	70-130
Uranium-238	7440-61-1	504	90.0	TBD	1,580	1.06	U isotopic – AEA or ICP/MS	1	1	≤30	70-130	≤20	70-130

Table 2-2. Analytical Performance Requirements for Nonradionuclides

COPC	Chemical Abstracts Service No.	Preliminary Action Level[a] (mg/kg): Direct Contact, WAC 173-340[b] (mg/kg): Method C Industrial	Preliminary Action Level[a] (mg/kg): Direct Contact, WAC 173-340[b] (mg/kg): Method B Unrestricted	Preliminary Action Level[a] (mg/kg): Groundwater Protection[c]	Preliminary Action Level[a] (mg/kg): Ecological Indicator Concentration (mg/kg)[d]	Hanford Site Background[e]	Name/ Analytical Technology[h]	Required Detection Limits (mg/kg)[f]: Water (mg/L)	Required Detection Limits (mg/kg)[f]: Soil (mg/kg)	Soil[g] (%): Precision	Soil[g] (%): Accuracy	Water[g] (%): Precision	Water[g] (%): Accuracy
Nonradioactive Metals													
Aluminum	7429-90-5	3,500,000	80,000	1,500	50	11,800	EPA Method 6020 or EPA Method 200.8	0.02	~~0.2~~2.0	≤30	70-130	≤20	80-120
Arsenic	7440-38-2	87.5	0.67	0.034	7	6.47	EPA Method 6010 ICP Trace or EPA Method 6020 or EPA Method 200.8	0.02	2	≤30	70-130	≤20	80-120
Antimony	7440-36-0	1,400	32	5.4	--	5[m]	EPA Method 6010 ICP Trace or EPA Method 6020 or EPA Method 200.8	0.006	0.6	≤30	70-130	≤20	80-120
Barium	7440-39-3	700,000	16,000	1,650	102	132	EPA Method 6010 ICP Trace or EPA Method 6020	0.005	0.5	≤30	70-130	≤20	80-120
Cadmium	7440-43-9	3,500	80	0.69	4	--	EPA Method 6010 ICP Trace or EPA Method 6020 or EPA Method 200.8	0.002	0.5	≤30	70-130	≤20	80-120
Chromium (total)	7440-47-3	Unlimited	120,000	2,000	42	18.5	EPA Method 6010 ICP Trace or EPA Method 6020 or EPA Method 200.8	0.002	0.2	≤30	70-130	≤20	80-120
Chromium (VI)	18540-29-9	10,500	240	0.2	--	--	EPA Method 7196 – colorimetric	0.01	0.5	≤30	70-130	≤20	80-120
Copper	7440-50-8	130,000	2,960	263	50	22	EPA Method 6010 ICP Trace or EPA Method 6020 or EPA Method 200.8	0.01	1	≤30	70-130	≤20	80-120
Lead	7439-92-1	1,000[L]	250[L]	270	50	10.2	EPA Method 6010 ICP Trace or EPA Method 6020 or EPA Method 200.8	0.005	0.5	≤30	70-130	≤20	80-120
Manganese	7439-96-5	490,000	11,200	65	1,100	512	EPA Method 6010 ICP or EPA Method 6020 or EPA Method 200.8	0.005	5	≤30	70-130	≤20	80-120
Mercury	7439-97-6	1,050	24	2.09	0.1	0.33	EPA Method 7470 (water) or EPA Method 200.8	0.0005	N/A	≤30	70-130	≤20	80-120
							EPA Method 7471 (soil) or EPA Method 200.8	N/A	0.2	≤30	70-130	≤20	80-120
Nickel	7440-02-0	70,000	1,600	130	30	19.1	EPA Method 6010 ICP or EPA Method 6020 or EPA Method 200.8	0.04	4	≤30	70-130	≤20	80-120
Selenium	7782-49-2	17,500	400	5.2	0.3	0.78[m]	EPA Method 6010 ICP or EPA Method 6020 or EPA Method 200.8	0.01	1	≤30	70-130	≤20	80-120
Silver	7440-22-4	17,500	400	13.6	2	0.73	EPA Method 6010 ICP or EPA Method 6020 or EPA Method 200.8	0.002	0.2	≤30	70-130	≤20	80-120

Table 2-2. Analytical Performance Requirements for Nonradionuclides

COPC	Chemical Abstracts Service No.	Preliminary Action Level[a] (mg/kg) — Direct Contact, WAC 173-340[b] (mg/kg) — Method C Industrial	Method B Unrestricted	Groundwater Protection[c]	Ecological Indicator Concentration (mg/kg)[d]	Hanford Site Background[e]	Name/ Analytical Technology[h]	Required Detection Limits (mg/kg)[f] — Water (mg/L)	Soil (mg/kg)	Soil[g] (%) — Precision	Accuracy	Water[g] (%) — Precision	Accuracy
Uranium (total)	7440-61-1	10,500	240	1.32	5	3.21	U total – kinetic phosphorescence analysis or EPA Method 200.8 or EPA Method 6020	0.001	1	$\leq$30	70-130	$\leq$20	80-120
Inorganics													
pH (corrosivity)	pH	--	--	--	--	--	EPA Method 9045 or SM4500 PH or EPA Method 150.1 or EPA Method 9040	0.1 pH unit	~~0.1 pH unit~~Not Applicable	$\leq$30	70-130	$\leq$20	80-120
Ammonia/ ammonium	7664-41-7	--	--		--	28	EPA Method 350.1[i] or EPA Method 300.7[j]	0.05	0.5	$\leq$30	70-130	$\leq$20	80-120
Chloride	16887-00-6	--		1,000	--	100	EPA Method 300.0	0.2	~~2~~55	$\leq$30	70-130	$\leq$20	80-120
Cyanide	57-12-5	70,000	1,600	0.80	--	--	EPA Method 9010 or EPA Method ~~9014~~ 9012 or SM4500E CN	0.005	~~0.5~~1.0	$\leq$30	70-130	$\leq$20	80-120
Fluoride	16984-48-8	210,000	4,800	24.1	--	200 (as fluorine)	EPA Method 300.0[k] – IC or EPA Method 9056	0.5	~~5~~25	$\leq$30	70-130	$\leq$20	80-120
Nitrate	14797-55-8	Unlimited	128,000	40	--	52	EPA Method 300.0[k] – IC	0.25	~~2.5~~12.5	$\leq$30	70-130	$\leq$20	80-120
Nitrite	14797-65-0	350,000	8,000	4	--	--	EPA Method 300.0[k] – IC	0.25	~~2.5~~12.5	$\leq$30	70-130	$\leq$20	80-120
Phosphate	14265-44-2	N/A	N/A	--	--	0.79	EPA Method 300.0[k] – IC	0.5	~~5~~25	$\leq$30	70-130	$\leq$20	80-120
Sulfate	14808-79-8	N/A	N/A	1,030	--	237	EPA Method 300.0[k] – IC	0.5	~~5~~27.5	$\leq$30	70-130	$\leq$20	80-120
Organics													
Acetone	67-64-1	Unlimited	72,000	28.9	--	--	EPA Method 8260 – GC/MS	0.02	0.02	$\leq$30	(q)	$\leq$20	(q)
Benzene	71-43-2	2,390	18.2	0.00483	--	--	EPA Method 8260 – GC/MS	0.005	0.005	$\leq$30	(q)	$\leq$20	(q)
n-Butyl Benzene	104-51-8	140,000	3,200	110	--	--	EPA Method 8260 – GC/MS	0.005	0.005	$\leq$30	(q)	$\leq$20	(q)
Carbon Tetrachloride	56-23-5	1,010	7.69	0.031	--	--	EPA Method 8260 – GC/MS	0.005	0.005	$\leq$30	(q)	$\leq$20	(q)
Chlorobenzene	108-90-7	70,000	1,600	0.874	40	--	EPA Method 8260 – GC/MS	0.005	0.005	$\leq$30	(q)	$\leq$20	(q)
Chloroform (trichloromethane)	67-66-3	21,500	164	0.0381	--	--	EPA Method 8260 – GC/MS	0.005	0.005	$\leq$30	(q)	$\leq$20	(q)
1,1-Dichloroethane	75-34-3	350,000	8,000	4.37	--	--	EPA Method 8260 – GC/MS	0.01	0.01	$\leq$30	(q)	$\leq$20	(q)
1,2-Dichloroethane	107-06-2	1,440	11	0.00232 below RDL[n]	--	--	EPA Method 8260 – GC/MS	0.005	0.005	$\leq$30	(q)	$\leq$20	(q)
trans-1,2-Dichloro-ethylene	156-60-5	70,000	1,600	0.543	--	--	EPA Method 8260 – GC/MS	0.005	0.005	$\leq$30	(q)	$\leq$20	(q)

2.2.5 Quality Control

The QC procedures must be followed in the field and laboratory to ensure that reliable data are obtained. Field QC samples will be collected to evaluate the potential for cross-contamination and provide information pertinent to field sampling variability. Field QC sampling will include the collection of field duplicates, split samples, and three types of field blanks (full trip, field transfer, and equipment rinsate blanks). Laboratory QC samples estimate the precision and accuracy of the analytical data. Field and laboratory QC samples are summarized in Table 2-4.

Table 2-4. Field and Laboratory Quality Control Requirements

Sample Type	Purpose	Frequency
	Field Quality Control	
Field Duplicate	Estimate precision, including sampling and analytical variability.	One per borehole~~20 soil samples collected.~~
Equipment Rinsate Blanks	Verify adequacy of sampling equipment decontamination.	As needed.[a] If only disposable equipment is used, then an equipment rinsate blank is not required. Otherwise, 1 per 20 samples, per media sampled.
Field Split	Indicate inter-laboratory variability.	~~As needed~~One per analytical method per media sampled.
Full Trip Blank	Detect contamination from containers or transportation.	One per borehole~~20 well trips~~.
Field Transfer Blank	Detect contamination from sampling site.	One each day VOCs sampled.
	Laboratory Quality Control[b]	
Method Blank	Assess response of an entire laboratory analytical system.	At least one per batch,[b] or as identified by the method guidance, *per media sampled.*
Matrix Spike	Identify analytical (preparation + analysis) accuracy; possible matrix affect on the analytical method used.	When required by the method guidance, at least one per batch,[b] or as identified by the method guidance, *per media sampled.*
Matrix Duplicate or Matrix Spike Duplicate	Estimate analytical accuracy and precision.	When required by the method guidance, at least one per batch,[b] or as identified by the method guidance, *per media sampled.*
Laboratory Control Samples	Assess method accuracy.	At least one per batch,[b] or as identified by the method guidance, *per media sampled.*

a. Whenever a new type of nondedicated equipment is used, an equipment blank shall be collected every time sampling occurs until it can be shown that less frequent collection of equipment blanks is adequate to monitor the decontamination procedure for the nondedicated equipment.

b. Batching across projects is allowed for similar matrices (e.g., Hanford Site groundwater). Maximum batch size is 20 samples.

VOC = volatile organic chemical/compound

3.2 Sampling Methods

Vadose zone soil samples will be collected at specific depths using either drive points advanced with DPT equipment, or split-spoon samplers advanced with conventional drilling technology.

3.2.1 Direct-Push Technology

Direct-Push Technology (DPT) uses pushing methods, such as a diesel hammer, hydraulic hammer, cone penetrometer, or GeoProbe,[1] to penetrate the vadose zone to collect soil samples and/or to obtain downhole geophysical data. These methods generally are limited in the depth of penetration and in sample volume, compared to conventional borehole drilling. However, they are also generally less expensive than drilling. Table 3-19 includes descriptions of various DPT technologies that may be employed to collect samples specified in this SAP.

Direct-push holes may be installed to obtain spectral gamma, neutron moisture, and/or passive neutron logs and/or vapor samples. Some DPTs also permit soil sampling. The number of samples and the depth of sampling are limited, and capabilities vary with each method.

Soil samples are collected from the direct-push hole using a driven sampling device, similar to a split-spoon sampler. Sampling is conducted first for volatile organic analysis, if required. Then soils are homogenized and subsampled for the remainder of the required analyses. Because of the limited sample size for DPT methods, focused analysis or analysis priorities may be necessary (Section 2.1.4.8). Table 3-19 lists the anticipated maximum depths for these technologies.

3.2.1.1 Single Borehole Approach

At most of the indicated DPT locations, one borehole will be pushed. Samples will be collected in accordance with the details of this SAP. Following sample collection, the borehole will be geophysically logged for both gamma activity and neutron moisture. Following logging, at least one deep electrode will be installed to support surface geophysical exploration. Nominally, the electrode will be placed near the bottom of the hole. This borehole will then be decommissioned.

3.2.1.2 Twin Borehole Approach

At some of the indicated DPT locations, two separate "twin boreholes" will be pushed. The initial borehole will be geophysically logged for both gamma activity and neutron moisture. Following logging, at least one deep electrode will be installed for surface geophysical exploration. Nominally, the electrode will be placed near the bottom of the hole. This first hole will then be decommissioned.

A second DPT borehole will be advanced in the immediate vicinity of the first, with samples being collected in accordance with the details of the FSP in this SAP (Section 3.1), but at depths that may be influenced by the geophysical logging and soil observations obtained by the first push. Section 3.2.3 provides the criteria for collecting samples in the second DPT hole, based on geophysical logging of the first DPT hole.

3.2.1.3 Sonic Capability and Continuous Coring Approach

This approach uses a combination of DPT and sonic drill method, equipped with a Dual Tube Sampling System for continuous soil coring. The Dual Tube Sampling System will retrieve continuous soil cores throughout the length of the borehole, as conditions allow. Geophysical logging for both gamma activity and neutron moisture will support the determination of sample collection intervals. This approach eliminates the need for a twin borehole approach and may be incompatible for grab sample collection.

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[1] GeoProbe is a registered trademark of GeoProbe systems, Salina, Kansas.

Where possible, between cores, or during core retrieval and storage, the geologist can observe the core sleeves and document the sediment. Grab samples for geologic description may be obtained from the remaining clean core sections after the scheduled sample volumes have been obtained.

Table 3-19. Direct-Push Technologies

Technology	Penetration Depth	Sample Size	State of Development	Comments	Relative Cost
Hydraulic hammer unit	Medium to Deep (61.0 m [200 ft], depending on geology)	2.7 cm (1.08 in.) diameter, 55.9 cm (22 in.) long	Commercial – widely available	Stymied by competent sediments, cobbles/ boulders	Medium
Cone penetrometer	Medium (<45.7 m [150 ft], depending on geology)	2.5 cm (1 in.) diameter, 0.6 m (2 ft) long	Commercial – widely available	Stymied by competent sediments, cobbles/ boulders	Medium
Enhanced Access Penetration System	Medium to Deep (76.2 m [250 ft], depending on geology)	2.5 cm (1 in.) diameter, 0.6 m (2 ft) long	Mature – some refinement needed for difficult conditions	Cone penetrometer that can also drill through fine sediments, boulders	Medium
GeoProbe*	Shallow (<30.5 m [100 ft])	2.5 cm (1 in.) diameter, 0.3 m (1 ft) long	Commercial – widely available	Stymied by competent sediments, cobbles/ boulders	Low to Medium

* GeoProbe is a registered trademark of GeoProbe Systems, Salina, Kansas.

3.2.2 Borehole Drilling

Borehole drilling can be conducted using a variety of equipment depending on data needs. For application to the 200-DV-1 OU characterization, drilling commonly uses a cable tool rig, or a similar type of rig that:

- Enables control of contaminated cuttings
- Permits spectral gamma, neutron moisture, and other types of downhole geophysical logging
- Provides adequate soil return to support soil sampling, either through a split-spoon sampler or through a grab sample

Table 3-20 includes descriptions of various conventional borehole drilling technologies that may be employed to collect samples specified in this SAP.

All drilling will be done using a method approved by the project, and will conform to site-specific technical specifications for environmental drilling services. Drill rigs for deep boreholes will generally require a gravel pad and, in some cases, a gravel access road. Cleaning and decontamination also will be performed in accordance with this SAP.

Special care should be taken to avoid the following common ways in which cross-contamination or background contamination may compromise the samples:

- Improperly storing or transporting sampling equipment and sample containers
- Contaminating the equipment or sample bottles by setting the equipment/sample bottle on or near potential contamination sources (e.g., uncovered ground)
- Handling bottles or equipment with dirty hands or gloves
- Improperly decontaminating equipment before sampling or between sampling events

The drill rig derrick, all downhole equipment, and temporary casing will be field decontaminated (e.g., high pressure and temperature wash), at a minimum, before mobilization and demobilization at each drilling location.

3.2.7 Radiological Field Data

Alpha and beta/gamma data collection in the field will be used as needed to support sampling and analysis efforts. Generally, cuttings from drilled boreholes (excluding slough) will be field screened for evidence of radiological contamination. Screening will be conducted visually and with field instruments. Radiological screening will be performed by the RCT or other qualified personnel. The RCT will record field measurements, noting the depth of the sample and the instrument reading. Measurements will be relayed to the field geologist for inclusion into the field logbook or operational records daily, as applicable.

The following information will be distributed to personnel performing work in support of this SAP.

- Instructions will be provided to RCTs on the methods required to measure sample activity and media for gamma, alpha, and/or beta emissions, as appropriate.
- Information regarding the Geiger-Müller, portable alpha meter, dual phosphor beta/gamma, and sodium iodide portable instruments, will include a physical description of the instruments, radiation and energy response characteristics, calibration/maintenance and performance testing descriptions, and the application/operation of the instrument. These instruments are commonly used on the Hanford Site for obtaining measurements of removable surface contamination measurements and direct measurements of the total surface contamination.
- Information on the characteristics associated with the hand-held probes to be used in the performance of direct radiological measurements will include a physical description of the probe, the radiation and energy response characteristics, calibration/maintenance, and performance testing descriptions, and the application/operation of the instrument. The hand-held probe is an alpha detection instrument commonly used on the Hanford Site for obtaining removable surface contamination measurements and direct measurements of the total surface contamination.

3.2.8 Corrective Actions and Deviations for Sampling Activities

The 200-DV-1 OU Project Manager, Field Team Lead, or designee must document deviations from procedures or other problems pertaining to sample collection, chain of custody, COPCs, sample transport, or noncompliant monitoring. Examples of deviations include samples not collected because of field conditions, changes in sample locations because of physical obstructions, or additions of samples. The 200-DV-1 OU field sampling strategy (Section 3.2.3) describes the criteria for selecting and modifying sampling intervals.

As appropriate, such deviations or problems will be documented in the field logbook or on nonconformance report forms in accordance with internal corrective action procedures.
The 200-DV-1 OU Project Manager, Field Team Lead, or designee, will be responsible for communicating field corrective action requirements and for ensuring immediate corrective actions are applied to field activities.

Changes in sample locations not affecting the DQOs will require notification and approval of the 200-DV-1 OU Project Manager. Changes to sample locations affecting the DQOs will require concurrence from DOE and the lead regulatory agency. If unanticipated high contamination is discovered by radiological screening of core or drill cuttings from the bottom (total depth) of the boreholes, a data review will be conducted and a decision will be made on possible extension of the borehole and additional sampling. Decisions to extend or add additional samples currently not defined in this SAP will be made with the consent of the DOE and the lead regulatory agency (Ecology). All of the push/continuous core boreholes have a total depth at or just above the Cold Creek unit. The drilled borehole will be drilled to the water table. Any decision to deepen and obtain additional samples will only be completed if the tasks are achievable using the drilling method available for this work. Changes to the SAP will be documented as noted in Section 2.1.6.

3.3 Documentation of Field Activities

Logbooks or data forms are required for field activities. Requirements for the logbook are provided in Section 2.1.5. Data forms may be used to collect field information; however, the information recorded on data forms must follow the same requirements as those for logbooks. The data forms must be referenced in the logbooks.

A summary of information to be recorded in logbooks is as follows:

- Purpose of activity
- Day, date, time, weather conditions
- Names, titles, organizations of personnel present
- Deviations from the QAPjP or procedures
- All site activities, including field tests
- Materials quality documentation (e.g., certifications)
- Details of samples collected (e.g., preparation, splits, duplicates, matrix spikes, blanks)
- Location and types of samples
- Chain-of-custody details and variances relating to chain of custody
- Field measurements
- Field calibrations and surveys, and equipment identification numbers, as applicable
- Equipment decontaminated, number of decontaminations, and variations to any decontamination procedures
- Equipment failures or breakdowns, and descriptions of any corrective actions

4 Health and Safety Plan

Field operations will be performed in accordance with health and safety requirements and appropriate CHPRC Soil and Groundwater Remediation Project requirements. Work control documents will be prepared to provide further control of site operations. Safety documentation will include an activity hazard analysis and, as applicable, radiological work permits. The sampling procedures and associated activities will implement ALARA practices to minimize the radiation exposure to the sampling team, consistent with the requirements defined in 10 CFR 835.

While many of the selected sampling intervals identified in Tables 3-2 through 3-18 of this SAP target those intervals expected to show the highest levels of contamination, it should be noted that this sampling will only be implemented if it can be performed safely. Excavating contaminated soils from intervals of medium-to-high radiological risk should be avoided to reduce the risk of exposure, if possible. If the CHPRC radiological hazard screening concludes one (or more) of the proposed sampling intervals is high or medium hazard radiological work, adjustments will be made to the proposed sampling depths as needed. In this situation, radiological control personnel will perform downhole dose rate measurements prior to authorizing soils to be extracted to the surface.